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Number of Terms.	Mid-Term or Pair of Mid-Terms.	The Series.
1	15	15
3	5	4+5+6
5	3	1+2+3+4+5
15	1	-6-5-4-3-2-1+0+1+2+3+4+5+6+7+8
2	7,8	7+8
6	2,3	0+1+2+3+4+5
10	1,2	-3-2-1+0+1+2+3+4+5+6
30	0,1	-14-13- . . . +0+1 . . . +14+15

NOTE ON PRIME NUMBERS.

By DERRICK N. LEHMER, University of California.

It is a well known theorem that it is possible to find an arbitrarily great number of consecutive composite numbers. This appears from the values which the expression $n!+r$ takes for $r=2, 3, \dots, n$. This theorem furnishes an interesting proof of the theorem that the number of primes less than or equal to x is not determined by a function of x which is a polynomial in x of finite degree. For if $f(x)$ were such a function of degree n , then for $x=(n+2)!+r$, $f(x)$ must keep the same value for $r=2, 3, 4, \dots, n+2$. If this value is k , then $f(x)-k=0$ is an equation of degree n with $n+1$ roots, which is impossible.

DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

362. Proposed by JAMES F. LAWRENCE, Stillwater, Okla.

Show that the number of solutions in positive integers, zero included, of the equation $x+2y+3z=6n$, is $3n^2+3n+1$.

Solution by W. J. GREENSTREET, M. A., Editor of the Mathematical Gazette, Burghfield, England.

$x+2y+3z=6n$. z may have any value from 0 to $2n$, inclusive.

Hence we may assign to it any even or odd value from 0 to $2n$, inclusive.

i. Let $z=2r$. $x+2y=6(n-r)$. y may have any value from 0 to $3(n-r)$.

\therefore There are $3(n-r)+1$ solutions when z is $2r$.

\therefore Total number of solutions for z even is

$$\begin{aligned}\sum_{r=0}^{r=n} [3(n-r)+1] &= (3n+1)(n+1) - \frac{3n(n+1)}{2} \\ &= \frac{n+1}{2} (6n+2-3n) = \frac{(n+1)(3n+2)}{2}.\end{aligned}$$

ii. Let $z=2r+1$. $x+2y=6(n-r)-3$. y may have any value from 0 to $3(n-r)-2$.

$\therefore 3(n-r)-2+1=3(n-r)-1$ solutions.

\therefore Total number of solutions when z is odd:

$$\sum_{r=0}^{r=n-1} [3(n-r)-1] = (3n-1)n - \frac{3n(n-1)}{2} = \frac{n}{2} (6n-2-3n+3) = \frac{n}{2} (3n+1).$$

\therefore The total number of solutions

$$= \frac{(n+1)(3n+2)}{2} + \frac{n(3n+1)}{2} = \frac{3n^2+5n+2+3n^2+n}{2} = 3n^2+3n+1.$$

Also solved by H. Prime, J. Scheffer, H. C. Feemster, and A. M. Harding.

363. Proposed by E. B. ESCOTT, Ann Arbor, Mich.

(a) If a and n be positive integers, the integral part of $[a+\sqrt{(a^2-1)}]^n$ is odd.

(b) If a and n be positive integers, the integral part of $[\sqrt{(a^2+1)}+a]^n$ is odd when n is even and even when n is odd. [From Todhunter's *Algebra*, p. 353].

I. Solution by the PROPOSER.

Proof. (a) Let $[a+\sqrt{(a^2-1)}]^n = P+Q\sqrt{(a^2-1)} = m$.

Then $[a-\sqrt{(a^2-1)}]^n = P-Q\sqrt{(a^2-1)} = 1/[a+\sqrt{(a^2-1)}]^n$.

$\therefore 0 < P-Q\sqrt{(a^2-1)} < 1$.

Adding m to each member of the inequality $m < 2P < m+1$.

Therefore, the integral part of m is odd.

(b) Let $[\sqrt{(a^2+1)}+a]^n = R+S\sqrt{(a^2+1)} = k$.

Then $[-\sqrt{(a^2+1)}+a]^n = R-S\sqrt{(a^2+1)} = \left(\frac{-1}{\sqrt{(a^2+1)}+a}\right)^n$.

If n is even, $0 < R-S\sqrt{(a^2+1)} < 1$. Adding k , $k < 2R < k+1$. Whence the integral part of k is odd.